

**TITLE: RANDOM INPUT MULTISTAGE VOLTAGE TRICKLE STORAGE SYSTEM  
FOR INTERMITTENT OR UNSTABLE VOLTAGES**

5

**BACKGROUND OF THE INVENTION**

(a) Field of the Invention

10 The present invention is ~~related~~ relates to a random input multistage voltage trickle storage system for storing voltages from intermittent or unstable power sources as well as from a power grid, and more particularly, to a circuit system ~~functioning as a storage by that utilizes a voltage difference of between~~ two or more than two stages comprised of two or more than two types of storage device, to store DC ~~source~~ converted from city power, or charging energy randomly; inputted from unstable ~~source~~ sources such  
15 as a solar cell or a windmill generator.

(b) Description of the Prior Art:

20 The prior art involves the input of DC power which has been converted from AC using a contact type conduction structure for random coupling, or using electric energy outputted from a solar cell or a windmill generator or other unstable sources, such as tide generation or vibration generation to drive ~~the~~ a load capable of random operation.

25 However, during ~~the~~ operation, the power supply is frequently disconnected due to ~~lacking in immediate power supply of random intermittent operation by of the~~ contact type conduction interface, or ~~being affected by the effect of~~ ambient factors in case of solar or wind energy, or instability in tide or vibration energy. To cope with these ~~defectives~~ defects, batteries are added to ensure a consistent supply of power in according to the following options:

30 (1) A primary battery with positive polarity is added in series with an isolation diode before being connected in parallel with the output side of a random input source (such as in the application of a calculator with a solar cell);

(2) A secondary (dis)chargeable battery is connected in parallel with the output side

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of a random input source;

(3) A super ~~capacity~~ capacitance is connected in parallel with the output side of a random input source; or

(4) A voltage stabilization ~~capacity~~ capacitance is connected in parallel with the output side of a random input source;

However these options are further found ~~with~~ to have the following ~~defectives~~ defects:

Option (1) is not very convenient since in the connection of the primary ~~batter~~ battery in parallel with the output side of the random input source, any insufficiency of electric energy in the primary battery requires immediate replacement.

For options (2) and (3), ~~a longer~~ standby time ~~of standby~~ for recharging is required to receive ~~the~~ DC voltage converted from the city power, or the output of a solar cell or the windmill ~~generation~~ through the contact type of conduction structure to allow for the rise up to normal working voltage, if the secondary (dis) chargeable ~~batter~~ battery or the super ~~capacity~~ capacitance functioning as the battery is at its low capacity. If a solar cell with higher capacity is used to simultaneously supply charging electric energy and loading electric energy, the installation of such a solar cell is comparatively expensive; ~~consuming~~ requires a larger area and ~~space to fail being practical and economic~~ and therefore is generally impractical and not economic. Furthermore, it is far more difficult to control the immediate charging by relying on windmill generation.

Option (4) requires connection of a stabilizing ~~capacity~~ capacitance in parallel and, if the capacity gets too small, ~~it fails~~ to provide a high density output or if the capacity becomes too high, ~~the similar defectives~~ defects to those found with option (3) appear.

## SUMMARY OF THE INVENTION

The primary purpose of the present invention is to provide a random input multistage ~~voltage-trickle-storage system~~ for unstable or intermittent voltages. To achieve ~~the~~ this purpose, a circuit system ~~functioning as a storage by~~ controls storage based on a voltage difference ~~of~~ between two or more than two stages is comprised of two or more

5 than two types of storage device, ~~to store for storing~~ DC source converted from city power, or charging energy randomly inputted from an unstable source such as a solar cell or a windmill generator to correct those ~~defectives~~ defects observed with the prior art.

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### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block chart showing a circuit of the present invention;

15 Fig. 2 is a view showing a circuit to regulate and limit inputted electric energy in Fig. 1, which is comprised of a voltage and amperage regulation circuit;

Fig. 3 is a view showing a circuit to regulate and limit inputted electric energy in Fig. 1, which is comprised of an amperage regulation circuit;

20 Fig. 4 is a view showing a circuit to regulate and limit inputted electric energy in Fig. 1, which is comprised of a voltage regulation circuit;

Fig. 5 is a view showing a circuit to regulate and limit inputted electric energy, which is comprised of a DC source taken from Fig. 1 connected first in parallel with a zener diode before being connected in series with an isolation diode in the positive direction of the current;

25 Fig. 6 is a view showing a circuit to regulate and limit inputted electric energy, which is comprised of a DC source taken from Fig. 1 connected in series with an isolation diode in the positive direction of the current;

30 Fig. 7 is a view showing a circuit to regulate and limit electric energy, which is comprised of a DC source taken from Fig. 1 having its both terminals connected in parallel with an isolation diode;

Fig. 8 is a view showing a circuit that a primary battery taken from Fig. 1, which is comprised of a capacity or a super capacity;

Fig. 9 is a view showing a circuit that a primary battery taken from Fig. 1, which is

5 comprised of a (dis) chargeable secondary battery;

Fig. 10 is a view showing a circuit ~~that in~~ corresponding to the circuit taken from ~~of~~ Fig. 1, in which a diode is connected in series with a circuit 108 ~~with so that~~ its outputted current ~~that can~~ be regulated and controlled;

Fig. 11 is a view showing ~~that the~~ a circuit taken from Fig. 1 ~~is and~~ comprised of a zener diode and ~~contains~~ a charging operation and control circuit, and a circuit to limit one-way outputted electric energy;

Fig. 12 is a view showing ~~that in the~~ a circuit taken from Fig. 1, in which a secondary ~~batter~~ battery is comprised of a ~~capacity~~ capacitance or a super ~~capacity~~ capacitance,

Fig. 13 is a view showing ~~that in the~~ a circuit taken from Fig. 1, in which a secondary ~~batter~~ battery is comprised of a (dis) chargeable secondary battery;

Fig. 14 is a view ~~showing that in the~~ a circuit taken from Fig. 1, in which a circuit to operate and control charging is not provided; instead, a secondary ~~batter~~ battery is comprised of a primary or a (dis) chargeable secondary battery or any other (dis)chargeable storage device;

Fig. 15 is a view showing ~~that in the~~ a circuit taken from Fig. 1, in which a circuit to operation and control charging is not provided and a circuit to regulate and limit inputted electric energy may be omitted; instead, a diode is used as a circuit to limit the one-way outputted electric energy, and a secondary battery is comprised of a primary battery or a (dis)chargeable secondary battery or any other (dis)chargeable storage device.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, a random input multistage ~~voltage trickle-storage~~ system for unstable or intermittent voltages ~~is essentially comprised of~~ includes:

- a DC source 100; ~~related to a DC source~~ comprised of a contact type conduction device and ~~rectified city power for random coupling to supply DC power at random to a rectified city power source~~, or to a DC source from a solar cell, windmill generation, tide or vibration energy or any other unstable DC or AC source, or a DC source converted from an AC source, ~~such as that unstable DC source converted from tide or vibration~~

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- 5 energy;
- ~~a and optional~~ circuit 101 to regulate and limit inputted electric energy: comprised of a diode or other one-way current transmission device or circuit, e.g., an electro-mechanical device, ~~or a controllable power chip, or a gate current, or other one-way~~ current transmission solid state circuit device or circuit, to regulate and control voltage
- 10 and amperage outputted from the DC source to a storage unit 102, and to ensure that the electric energy can only be outputted from the DC source 100 to each storage unit and output terminal ~~as any while~~ input to the DC source 100 is prevented; ~~and the circuit 101 is~~ optional; and
- 15 - a storage unit: 102: containing a first storage device 103 comprised of a ~~capacity~~ capacitance, ~~or a super capacity capacitance~~ or a secondary battery, to be connected in parallel with the DC source 100 and output terminal, and the output terminal of the first storage device 103 may be further connected in series with an isolation diode 104 in the positive direction as required by the circuit; a second storage device 105 provided with a
- 20 ~~capacity, capacitance~~ or super ~~capacity~~ capacitance, or a primary battery or a secondary battery, connected first in series with a one-way electric energy output limiting circuit 106, ~~the then~~ in parallel with the power source and output terminal; a circuit 108 to regulate and control outputted amperage provided with the one-way electric energy output limiting circuit 106 and comprised of a diode 107 or other one-way current
- 25 transmission device or circuit, e.g., an electro-mechanical device or controllable power chip or gate current, or other one-way current transmission solid state circuit device or circuit, so to ensure that the secondary battery device can only output electric energy to the source side and load side connected in parallel ~~as while the~~ electric energy input the secondary battery device is prevented; and ~~a an optional~~ charging operation and control
- 30 circuit 111 comprised of a ~~positive bias of a positively-biased~~ diode 109, ~~or a zener~~ diode 110, or an electro-mechanical device or solid state circuit device; that is connected in parallel with both terminals of the one-way electric energy output limiting circuit 106, to operate and control setting up the voltage for the DC source to

5 commence charging the second storage device 105, or to further limit its charging current and to convert its charging saturation to the status of maintaining charging or circuit breaking when the second storage 105 is comprised of a ~~capacity~~ capacitance, a super ~~capacity~~ capacitance, or a (dis)chargeable secondary battery or other chargeable storage device; ~~in practice, the charging control and operation circuit is optional.~~

10 Fig. 2 is a view showing inclusion of a voltage and amperage regulation circuit to regulate and limit ~~inputted input~~ electric energy in the circuit of Fig. 1. ~~is comprised of a voltage and amperage regulation circuit; within, an~~ The optional circuit for regulating voltage and amperage may be comprised of an electro-mechanical device or solid state electronic device ~~may be provided connected~~ between the DC source 100 and the  
15 storage unit 102 to operate and control the voltage and current outputted from the DC Source ~~source~~ 100 for limit-supplying limited or constant voltage and ~~limit~~ or constant current to be outputted to the first storage device 103 of the storage unit 102, ~~and if the.~~ If an optional isolation diode 104 is connected in series, such current and voltage ~~is~~ may be further outputted to the next stage of a storage circuit connected in parallel  
20 and comprised of the second storage device 105 and the one-way electric energy output limit circuit 106 for further output.

Fig. 3 is a view showing a circuit to regulate and limit ~~inputted input~~ electric energy in Fig. 1 is comprised of an amperage regulation circuit; ~~wherein, an.~~ The optional current regulation circuit is comprised of an electro-mechanical device or solid state electronic  
25 device ~~is~~ provided between the DC source 100 and the first storage device 103 of the storage unit 102, to execute operation and control ~~of~~ to limit or supply constant current ~~on~~ to the output from the DC source 100 before being further outputted to the first storage device 103 of the storage unit 102; ~~and if.~~ If the optional isolation diode 104 is connected in series, the output from the DC source 100 may be further outputted to the  
30 next storage circuit connected in parallel and comprised of the second storage device 105, the one-way electric energy output limit circuit 106, and a charging operation and control circuit 111 for further output.

Fig. 4 is a view showing a circuit to regulate and limit ~~inputted input~~ electric energy in



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5 Fig. 1 is comprised of a voltage regulation circuit; ~~within, an.~~ The optional voltage regulation circuit is comprised of an electro-mechanical device or solid state electronic device ~~is~~ provided between the DC source 100 and the first storage device 103 of the storage unit 102, to execute operation and control of limit or constant voltage on the output from the DC source 100 before being further outputted to the first storage device  
10 103 of the storage unit 102; and, if the optional isolation diode 104 is connected in series, further outputted to the next storage circuit connected in parallel and comprised of, the second storage device 105, the one-way electric energy output limit circuit 106, and a charging operation and control circuit 111 for further output.

Fig. 5 is a view showing a circuit to regulate and limit inputted electric energy is  
15 comprised of a DC source taken from Fig. 1 and connected first in parallel with a zener diode before being connected in series with an isolation diode in the positive direction of the current; wherein, a zener diode 112 is directly connected in parallel with both terminals of the DC source 100 (a drop resistance may be connected in series before the connection of the zener diode 112 if required), ~~then the~~ Then, an isolation diode 113  
20 is connected in series in the positive direction of the current before being outputted to the first storage device 103 of the storage unit 102, and if the optional isolation-diode 104 is connected in series, further outputted to the next storage circuit connected in parallel and comprised of the second storage device 105, the one-way electric energy output limit circuit 106, and a charging operation and control circuit 111 for further  
25 output.

Fig. 6 is a view showing a circuit to regulate and limit inputted electric energy is comprised of a DC source taken from Fig. 1 connected in series with an isolation diode in the positive direction of the current; ~~the.~~ The isolation diode 113 is connected in series in the positive direction of the current with the DC source 100, then outputted to  
30 the first storage device 103 of the storage unit 102; and, if the optional isolation diode 104 is connected in series, further outputted to the next storage circuit connected in parallel and comprised of the second storage device 105, the one-way electric energy output limit circuit 106, and a charging operation and control circuit ill for further output.

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5 Fig. 7 is a view showing a circuit to regulate and limit inputted electric energy, is  
comprised of a DC source taken from Fig. 1 having its both terminals connected in  
parallel with an isolation diode; ~~wherein, the~~ The zener diode 112 is directly connected  
in parallel with both terminals of the DC source 100 (a drop resistance may be  
connected in series before the 20 connection of the zener diode 112 if required) then  
10 outputted to the first storage device 103 of the storage unit 102, and, if the optional  
isolation diode 104 is connected in series, further outputted to the next storage circuit  
connected in parallel and comprised of the second storage device 105, the one-way  
electric energy output limit circuit 106, and a charging operation and control circuit 111  
for further output.

15 Fig. 8 is a view showing a circuit ~~that in which~~ a primary battery taken from Fig. 1 is  
comprised of a ~~capacity or a super-capacity~~ capacitance or super-capacitance; wherein,  
~~the capacity or super-capacity~~ 114 that provides the a storage function for the first  
storage device 103.

20 Fig. 9 is a view showing a circuit ~~that in which~~ a primary battery taken from Fig. 1 is  
comprised of a (dis) chargeable secondary battery; ~~wherein, the (dis)chargeable~~  
~~secondary battery that~~ provides storage function for the first storage device 103.

Fig. 10 is a view showing a circuit ~~that in the circuit~~ taken from Fig. 1, in which a  
diode is connected in series with a circuit 108 ~~with its outputted current that can be~~  
~~regulated and controlled; wherein, the~~ for controlling an regulating an output current,  
25 and in which diode 107 is connected in series with the circuit 108 to regulate and control  
the outputted current, before being connected in parallel with the charging operation  
and control circuit 111 in the same direction of the current, and further connected in  
series with the second storage device 105 for the charging operation and control circuit  
111 to control the charging current of the second storage device 105, and for the circuit  
30 108 and the diode 107 to regulate and control its output current.

Fig. 11 is a view showing that the circuit taken from Fig. 1 is comprised of a zener  
diode and contains a charging operation and control circuit, and a circuit to limit one-  
way outputted electric energy; wherein the circuit is comprised of the zener diode 115



5 ~~while containing which effectively performs~~ the functions of that ~~from the~~ charging  
operation and control circuit 111 and one-way electric energy output limit circuit 106;  
~~wherein, the zener diode 115 provides the functions of that from the charging operation~~  
~~and control circuit 111 and the one-way electric energy output limit circuit 106, within,~~  
the. The zener voltage function of the zener diode 115 is used to provide the function  
10 of the charging operation and control circuit to limit the voltage, and an output route is  
created by the diode effect in a reverse direction of the zener diode 115.

Fig. 12 is a view showing that in the circuit taken from Fig. 1, ~~a secondary batter is~~  
~~comprised of a capacity or a super capacity; wherein, the second storage device 105 is~~  
~~comprised of the capacity or the~~capacitance or super capacitycapacitance 116. Fig. 13  
15 is a view showing that in the circuit taken from Fig. 1, ~~a secondary batter is comprised~~  
~~of a (dis)chargeable secondary battery; wherein, the second storage device 105 is~~  
comprised of any type of (dis) chargeable secondary ~~batter~~battery 117.

Fig. 14 is a view showing that in the circuit taken from Fig. 1, a circuit to operate and  
control charging is not provided, ~~instead.~~ Instead, a secondary ~~batter~~storage device  
20 105 is comprised of a primary or a (dis) chargeable secondary battery or any other (dis)  
chargeable storage device; ~~wherein, the charging operation and control circuit 111 is~~  
~~not provided; instead, the second storage device 105 is comprised of a primary or~~  
~~(dis)chargeable secondary battery or any other (dis)chargeable storage device.~~

Fig. 15 is a view showing that in the circuit taken from Fig. 1, a circuit to ~~operation~~  
25 ~~and control charging is not provided and a circuit to regulate and limit inputted electric~~  
~~energy may be omitted, instead.~~ Instead, a diode is used as a circuit to limit the one-  
way outputted electric energy, and ~~a secondary battery is comprised of a primary~~  
~~battery or a (dis)chargeable secondary battery or any other (dis)chargeable storage~~  
~~device, wherein both of the charging operation and control circuit 111 and the optional~~  
30 ~~circuit 101 to regulate and limit the inputted electric energy are omitted; instead, the~~  
function of the one-way electric energy output limit circuit 106 is provided by the diode  
107 and the second storage device 105 ~~is~~ comprised of a primary or (dis) chargeable  
secondary battery or any other (dis) chargeable storage device.

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5 All the preferred embodiments of the random input multistage ~~trickle-storage~~ system of the present invention are cost efficient and compact when compared to the prior art. Given ~~with~~ a solar cell with its output voltage 3v, amperage of 5 ma, and a working current of 400 ma for the pulse load of the power controlled device, the solar cell is not capable ~~for~~ of directly driving the load and an auxiliary storage device must be added. If  
10 the auxiliary storage device has a smaller capacity, it means frequent recharging is required for each round or a few rounds of operation and control. Another flaw is ~~found~~ that during ~~the~~ intermittent operation ~~and~~ a longer time of standby is available for recharging, but the electric energy to be recharged is very limited due to earlier saturation for the smaller capacity. ~~On the contrary~~ However, if a super capacity  
15 capacitance or a secondary battery with larger capacity is used, the ~~defective~~ defect in its operation is that a longer time will be required for the recharging when the voltage of the battery is ~~at~~ low upon start-up.

Should the random input multistage ~~voltage-trickle-storage~~ system of the present invention be applied in random coupling ~~in to~~ a structure provided with a contact type  
20 conduction structure, or ~~in a~~ an intermittent power control device driven by a solar cell such as a calculator, remote ~~controller~~ control, mouse, keyboard or any other cordless power controlled peripherals, the present invention offers the following improvements:

- whereas the system of the present invention is provided with a first storage device  
25 and a second storage device and the latter is comprised of a super capacity capacitor or a secondary charging battery of larger capacity, immediate operation upon start-up is possible in the presence of sufficient voltage from the second storage device; ~~if~~ If such sufficient voltage from the second storage device is not available, the first storage device with the smaller capacity has the top priority to be charged by the solar cell to  
30 ~~make expedite the~~ start-up operation ~~soonest possible while~~ disregarding how low the voltage is from the first storage device; ~~on the contrary, under~~ Under the same conditions, a longer stand-by upon start-up is required in the conventional circuit for lacking in ~~such a~~ random input multistage ~~voltage-trickle-storage~~ system, and the

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- 5 operator has to wait ~~up~~until its single high capacity storage device ~~being~~is charged to reach the working voltage;

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5 - during the longer ~~subsequent~~ period necessary to receive the optical energy ~~by the~~  
from a solar cell, the first storage device with lower storage capacity is first charged up  
to the preset voltage, then the second storage device is automatically and immediately  
charged for storage of more electric energy. Furthermore, as may be required by the  
operation, the random input multistage ~~voltage-trickle~~ storage system allows the  
10 following options for its first storage device 103, ~~the~~ second storage device 105, the  
one-way electric energy output limit circuit 106 and ~~the~~ charging operation and control  
circuit 111:

- the relationship of storage capacity among the storage devices is as follows: the  
storage capacity of the first storage device 103 < the storage capacity of the second  
15 storage device 105 < the storage capacity of the third storage device < ... and so on to  
constitute a multistage DC supply system ~~of~~ for unstable source power sources;

- with the exception of the first storage device, the one-way electric energy output limit  
circuit 106 and the charging operation and control circuit 111 both have to be added in  
series with the second storage device and any storage device of a subsequent stage;

20 - the one-way electric energy output limit circuit 106 and the charging operation and  
control circuit 111 are connected in parallel, then respectively connected in series with  
the second storage device 105 and the third storage device or any subsequent storage  
device; so that after the first storage device 103 has been charged to its preset voltage,  
the charging is immediately and automatically provided to the second storage device  
25 105; ~~in turn, and~~ when the second storage device 105 is charged up to its preset  
voltage, the charging is immediately and automatically provided to the third storage  
device, and so on to constitute ~~the~~ a random input multistage ~~voltage-trickle~~ storage  
system;

- a charging source to first charge the first storage device 103, then the second  
30 storage device 105, and so on to constitute the random input multistage ~~voltage-trickle~~  
storage system; and

- the one-way electric energy output limit circuit 106 and the charging operation and  
control circuit 111 are connected in parallel, then respectively connected in series with  
the second storage device 105 and the third storage device or any subsequent storage

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5 device so ~~for~~ that the first storage device 103, the second storage device or any additional storage device of ~~the~~ a subsequent stage ~~to~~ may jointly supply the power to the load.

All the preferred embodiments of the present invention and their application disclosed above are for the description of their working principles and shall not be deemed as  
10 conclusive to limit any other combination which maybe selected by following those principles in practical applications.

~~—A random input multistage voltage trickle system of the present invention by offering the operation and control characteristics of multistage voltage trickle storage improving  
15 the instant power supply to the system load is innovative. Therefore, this application is duly filed accordingly~~